

## MANUFACTURE OF A GARMENT AND SUCH A GARMENT

### Background of the invention

5 The present invention concerns a method for manufacturing a clothing article for persons with a hernia, preferably an ostomy hernia, which clothing article is made for exerting compression on the user and intended for being disposed around the lower part of the body of the user. The invention furthermore concerns such a clothing article.

10 By hernia, as used in the present patent application, is understood an abnormal protrusion of an organ or parts thereof through the wall of a body cavity. With hernia is furthermore understood a bulging appearing around a site of operation, e.g. after an ostomy operation.

15 For persons suffering from hernia, it is important to use a bandage or clothing article that exerts compression against the skin in order that the hernia is kept in place inside. Such a bandage or clothing article may also be used as a preventive measure.

20 In particular for persons that have gone through an ostomy operation, and who subsequently have acquired an ostomy hernia, it is important to get a bandage or clothing article which exert compression in an area around the ostomy aperture. Furthermore, it is important that the ostomy aperture fits exactly to the type of ostomy bag used by each individual person, and which at the same time is correctly disposed in the clothing article. If the aperture in the clothing article is too narrow, it can be difficult to  
25 mount the ostomy bag, and if the aperture is too large, there will be a risk that the hernia or a part thereof is pressed out through the aperture.

30 A number of clothing articles are known where the required compression is produced by different belts and straps which are tightened by being taken on, or after the user has put the clothing article on. By having elastic bands extending in circumferential direction, desired compression can be established after the user having put on the clothing article. However, such products will be unsuitable for use with ostomy hernia,

as the user can displace the ostomy aperture by tightening the belts, which can be critical. Furthermore, the belts are hard, rigid and thick and therefor difficult to mount, particularly for persons with weak fingers.

5 For persons with ostomy hernia, there are methods where clothing articles are tailored to the individual patient. Thus the clothing article is made individually according to the detailed measures of the patient. After the patient has been measured, a centre for the ostomy is determined. After that, data concerning the clothing article and the associated ostomy bag are sent to the producer who makes an individually tailored clothing  
10 article including an aperture for the ostomy in the bandage. As mentioned, it is important that this aperture, both with regard to size and to position, is correctly placed so that problems do not occur when the ostomy bag is passed out through the ostomy aperture of the clothing article.

15 Some of the prior art clothing articles for ostomy hernia are made in elastic material in which extra abdominal reinforcements are sewn for keeping the hernia in place. Furthermore, the edge of the ostomy aperture will be reinforced with an edge band, synthetics or other, so that the ostomy aperture is stable during use. Furthermore, the clothing article may internally be provided with a sewn reinforcement.

20 The prior art products with adjustable belts will clutter much under the clothing and are uncomfortable and may, as mentioned, be difficult to dispose correctly since there is a risk that the correct position of the ostomy aperture is not secured. The tailored products are also very little flexible since they are only suited for one person. The  
25 product is thus not suited for mass production by individual adaptation, such as feasible with the clothing articles based on using adjustable belts. The tailored product will furthermore be disadvantageous since it is adapted to a person with a given size. By weight increase or weight loss there will therefore be a need for making new clothing articles.

30 The reason for the present invention is a desire of only making one clothing article, preferably in the shape of a panty brief, for persons with hernia, irrespectively whether this is a common hernia or an ostomy hernia. Particularly it is desirable to make a

clothing article which does not have the drawbacks of the prior art products, which is flexible in making and adaptation, and which therefore is suited for mass production. It is thus desirable to be able to produce clothing articles in a predefined variation of size and shape which has anatomical adaptation to users with different size. Furthermore it is desirable to make a comfortable clothing article that establishes the required compression for the daily use of the person, and which additionally can be used as "measuring panty brief" for use in determining the centre of an ostomy when speaking of an ostomy hernia or other operation hernia.

10 The object of the present invention is to provide a clothing article, preferably in the form of a panty brief which is suited for mass production and which nevertheless is easy to put on, and which simultaneously is suited for persons with hernia, preferably ostomy hernia or other operation hernia, as there is provided a size and a shape providing a fit which even at small variations in body size and shape ensure correct compression and possibility of a correct and secure positioning of an ostomy aperture in the clothing article.

20 According to the invention, this is achieved with a method of the kind mentioned in the introduction, which is peculiar in knitting a seamless tubular item, which is made with anatomic fit, in a predefined size and shape and establishing a firm yet elastic structure for producing compression of between 15 to 50 mmHg within a previously selected area of the clothing article.

25 In a particular embodiment, the method includes a step for extending the material in the tubular item for establishing the firm yet elastic structure in a clothing article with desired fit.

30 In a particular embodiment, the method according to the invention may be peculiar by a step placing the tubular item on a form with a predefined size and shape for selective fixation of the item while located on the form.

The clothing article according to the invention is peculiar in that it is formed by a seamless, knitted, tubular item which is intended for being disposed around the lower

body part of the user, and which is made with a firm yet elastic structure for forming a compression between 15 and 50 mmHg within a pre-selected area of the clothing article in order to provide an anatomical fit with a predefined size and shape.

5 The clothing article is preferably extended or fixed in order to be made with anatomical fit in the predefined size and shape. Furthermore, the clothing article is preferably peculiar in that the tubular item is sewn together at one end for forming a panty brief with a lower body part, groin area and leg openings.

10 By the invention there is thus created a clothing article that has an anatomical adaptation in size and shape with a variation which is selected in advance. It may be said that a clothing article is formed which in non-extended or 'slack' condition has a greater size, making it easier for the user to put on the clothing article, even if it has a compression which is necessary for supporting a hernia. The formed compressive area will  
15 preferably be formed on the front side of the clothing article.

According to the invention, it is thus possible to form a compressive area which can be used to prevent and/or secure a hernia, e.g. in connection with ostomy. The compression is created by knitting a high percentage of elastic yarns, e.g. elasthane, possibly in  
20 combination with a compact knitting structure and a firm, tight stitch pattern. Due to extension, the clothing article will become easier to put on since it is formed with a size which is 'greater' than a clothing article with corresponding properties for compression. Possibly, the clothing article is formed particularly larger in areas for buttocks and hips.

25 If the clothing article is to be used in connection with ostomy, the compression area is to have such nature that the aperture can be made on the relevant place without the material breaking, e.g. because of laddering. This is established by a suitable choice of knitting structure, edge covering, heat fixation or other sealing, e.g. by silicone or PU-  
30 film. With such techniques it is possible to avoid that the clothing article breaks when forming an ostomy aperture. Possibly the aperture is laced to ensure that the hernia is not partially penetrating out of the aperture.

If the clothing article is to be used for common hernia, for example hernia in the abdomen, no aperture formation is required. After measuring and testing the 'measuring panty brief' on the patient, the latter is equipped with clothing articles with size and shape providing the correct anatomical fit and compression.

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If speaking of a patient with ostomy hernia, a measurement of the patient will be performed in the first place, after which a clothing article with suitable shape and size is selected. After measuring the patient, a "measuring panty brief" in the shape of a clothing article that may have a particular pattern or network is selected. Localisation of the position of the ostomy aperture is established. The correct position and indication of size are sent to the producer who then adapts models of use of the clothing article by forming the ostomy aperture in the indicated position. It is thus possible to take a number of clothing articles with a predetermined size and shape and then provide these with an ostomy aperture in the correct position.

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The user will then have a number of clothing articles in which the ostomy aperture is disposed correctly, and which is made with an elasticity providing the desired compression without need for sewing extra reinforcements, elastic bandages, bands or similar. The clothing article is thus suited for disposition directly on the body without cluttering too much or being uncomfortable, so that the user may have possibility of using his usual clothes upon them. Furthermore, the user may easily and rapidly order extra clothing articles without needing to show up for taking new measurement and for adapting the clothing article.

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When the clothing article has been extended and possibly fixed in anatomic fit, it will exert correct compression in the areas, where it may be desired. Thus there is formed a firm contact pressure against the body, ensuring correct position of an ostomy aperture, irrespectively of the user being physically active. Thus there is no risk of the clothing article being displaced so that there is need for adjustments over the day. Due to the inherent elastic ability of the clothing article, there will be possibility of maintaining a fit, irrespectively of the user having a small loss of weight or increase in weight.

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Since the clothing article is made without side seams, no local pressure actions occur which can be inconvenient for the user, and which can give rise to skin injuries caused by the pressure forces occurring on the background of the compression in the product. In that connection it is to be mentioned that the compression used in the product may  
5 vary from 15 to 50 mmHg.

The clothing article according to the invention can be made by circular knitting on a body size machine or be made on a rectilinear knitting machine with two needle bars. The machines will preferably be controlled electronically, enabling possibility of  
10 variations in the choice of yarn, knitting structure, stitch width, and, regarding the rectilinear knitting machine, inserting and taking out.

In that connection it is noted, that the rectilinear knitting machine is distinguished by the possibility of a better fit, as there is possibility of taking out/in and hereby form a  
15 shape in the basic item. However, the rectilinear knitting process is relatively slow compared with the circular knitting.

Circular knitting is distinguished by being made as a seamless product with a size corresponding to the circumference of the body. Hereby is produced a tubular item where  
20 variation of the yarn composition over the height and circumference of the item may be established. Thus it is preferred to have a larger part of elastic yarn in the part intended for use in the upper part of the item at the abdominal region of the user, while there is used a lesser part of elastic yarns in the lowermost part of the item. The low-  
25 ermost part of the item may either be disposed opposite to the user's hips in an abdominal-support-like clothing article, or in a preferred embodiment, will become sewn together for forming a panty brief with lower body part area, groin area and leg openings. This sewing together may be performed before or after possible fixation of the clothing article on the form.

30 By making the clothing article as a panty brief, the clothing article is used as alternative for traditional fixation bandages in combination with usual panty briefs.

For persons having ostomy hernia, the clothing article will usually be positioned once

a day, and due to the ostomy bag it will not be possible to take off the clothing article in connection with urination. Therefore, it is preferred that an opening is provided in the groin area of the panty brief so that there is no need for removing the clothing article for urination.

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The clothing article in the form of a panty brief may be made with or without a fly.

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When making the clothing article, it is possible to use different parts of elastic yarns over the height and circumference of the tubular item in order thereby to provide variation in fit as well as variation over the height of the tubular item.

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According to a particular embodiment, elastic yarns, preferably elasthane, are used in a part between 15 and 60%, preferably between 30 and 50%, of the areas of the clothing article, which are to exert compression on the user's body. In other areas, e.g. the groin area in a panty brief, the share of elastic yarns will be substantially less, e.g. between 0 and 15%. Furthermore, it will be possible that these areas, as e.g. opposite the buttocks of the user, are formed with more loose knitting.

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Alternatively, knitting with different yarns, e.g. thin yarns, or yarns that crimp less, may be applied. The fixation will hereby provide possibility of improving anatomical adaptation of the clothing article and thereby provide a more correct and secure positioning with compression against the user's body in the areas where there the need exists.

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When manufacturing the clothing article, the compression area will typically be placed at one half of the tubular item, which is intended for disposition at the front side of the user. However, a compression in the area necessitates an annular elasticity in the entire circumference of the tubular item. However, the elasticity in the circumference of the tubular item will be affected in areas with compression. Thus there is established an extension and possibly a heat fixation within the compression area, so that a firm yet elastic structure is established in this area of the formed clothing article.

Putting on and taking off is of considerable importance to hernia patients. A signifi-

cant part of hernia or ostomy patients will typically be elderly persons with reduced strength in the fingers. Therefore, it is important that the clothing article is easy to put on and take off. At the same time, it is important that the clothing article can provide the required compression while in use.

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Until now, this has been achieved by using belts and straps which are tightened at or after applying the clothing article.

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By a clothing article according to the invention, it is possible to facilitate putting on and taking off according to different methods. The clothing article may e.g. be provided with opening devices such as zippers, Velcro closer, snap fasteners etc. Alternatively, looser quality of the fabric in the buttock areas may be provided. Also, it is possible to make the clothing article with a readily extendible rubber band at the waist. This may either be knitted in or sewn on.

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It is also possible to operate with reduced compression, e.g. in the back piece of the clothing article in relation to the compression area at the front side of the user. This may be established via the extension/heat fixation, or by varying yarns, knitting methods etc. It is also possible to make a clothing article in the shape of a panty brief without any kind of compression in the lower part. This may also be effected by the choice of yarns, knitting structure, or by reducing or omitting parts of elastic yarns or by sewing in a wedge that increases the leg width/groin width.

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Practical experiments have shown good results in clothing articles where the compression area has the above elasthane shares, and where elasthane yarn thickness is from 100 to 350 dtex, preferably from 150 to 250 dtex. The elasthane yarn may be single thread or be braided with thin yarn (typically PA, PES, cotton or viscose).

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The knitting structure in the compression area may be looping on all threads or traps ~~on~~ every other needle. The weight per square meter of the material will preferably be in a range between 250 and 450 g/m<sup>2</sup>, particularly between 300 and 400 g/m<sup>2</sup>. In other areas of the clothing article, the elasthane percentage will typically be less, the elasthane yarn thickness the same or less, the knitting structure possibly more loose and the



square meter weight typically lower thereby.

### Description of the drawing

The invention will then be explained in more detail with reference to the accompanying schematic drawing, wherein:

- Fig. 1 shows a first embodiment of a clothing article made by a method according to the invention,
- Fig. 2 is a sectional view on the line II-II in Fig. 2,
- Fig. 3 a view of a second embodiment of a clothing article made according to a method according to the invention,
- Fig. 4 the third embodiment of a clothing article which is made by a method according to the invention,
- Fig. 5 a curve showing in principle the relation between elongation measured in % and force in a clothing article made by a method according to the invention,
- Fig. 6 a fourth embodiment of a clothing article made by a method according to the invention,
- Fig. 7 a fifth embodiment of a clothing article made by a method according to the invention,
- Fig. 8 a sixth embodiment of a clothing article made by a method according to the invention,
- Fig. 9 a cross-section on the line IX-IX on Fig. 8,
- Fig. 10 a seventh embodiment of a clothing article made by a method according to the invention, and
- Fig. 11 an eighth embodiment of a clothing article made by a method according to the invention.

Fig. 1 shows a clothing article in the shape of panty brief 1. The panty brief includes a band 2, a lower body part area 3, a groin area 4 disposed between leg openings 5. The panty brief is seen from the front, and the panty brief includes a compression area 6.

In the shown embodiment, the compression area only includes the half part of the panty brief intended to be placed at the front side of the user, but for achieving a suffi-

cient compression, alternatively it will be possible that the compression area 6 also includes the backpiece of the panty brief entirely or partly within the same area delimited within a same annular area 7 situated between the outer limits 8 and 9, respectively.

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The compression is established by knitting in a very high part of elasthane which can occur in combination with a compact knitting structure and a firm stitch pattern. The illustrated panty brief 1 appears as a mass produced product which is ready for being provided with an ostomy aperture (not shown).

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Fig. 2 shows that the panty brief is provided with a groin opening 10 disposed between two Velcro bands 11, 12. Alternatively, the opening 10 may be provided with snap fasteners or other reclosable devices.

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Fig. 3 shows a second embodiment of panty brief 13. This embodiment differs from the embodiment shown in Fig. 1 by being provided with legs 14. In the shown embodiment, a wedge 15 has been sewn into the groin area 4 for providing good anatomical fit with consequent comfort for the user.

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Fig. 4 shows a third embodiment of a panty brief 16 with high cutout for the leg openings 5. On the back side, an area 17 of a quality with looser knitting may be provided in order thereby to achieve fit for the user's buttocks and thereby good anatomical fit.

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In order to achieve that the clothing articles are to be tailored to each individual user, it is important that the material of the clothing article has a curve including a largely flat force-elongation characteristic over a part of the curve pattern. This is illustrated in Fig. 5.

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By attaining a flat curve pattern between force and elongation expressed by the elongation in percent, it is possible to achieve sufficient but not too high compression, even though lesser variations occur in the user's size. The user can thus undergo weight loss or weight increase within a certain interval without there being any appreciable effect on the force and thereby the compression exerted by the clothing article.

Furthermore, it will also be possible to make the clothing article in a limited number of different sizes and at the same time enable that different users within a certain size interval can use the same size of clothing article. Also, a clothing article with flat curve pattern between increase in force and elongation will make it possible to reduce the number of shapes, as compensation can be made for different anatomical shapes, e.g. narrow waist, heavy hips and thighs, or the opposite. Within different shapes, the clothing article will still exert an appropriate compression in the compression area of the clothing article.

Technically, it is possible to make the panty brief with shape adaptation by taking stitches in or out when using rectilinear knitting. Furthermore, it is possible to perform adjustment of knitting firmness and to use different knitting structures or to insert wedges, as e.g. indicated by the wedge 15 in Fig. 3 in order to achieve adaptation of the shape of the clothing article.

A curve pattern with a flat area for the force-elongation is achieved by using elasthane yarns and by choosing elasthane-thickness, elasthane-types and knitting patterns. The elasthane yarns may be single-threaded yarns or braided yarns.

Furthermore, the curve is established by complete or part fixation of the clothing article. By the fixation it is possible to change the pattern of the force-elongation curve 18. By pre-stressing the clothing article, it is possible to reach a first point 19 more rapidly on the approximately flat part 20 of the curve 18. Then it is possible to increase elongation largely without changing the force/compression until a second point 21 is reached, which defines the second outer point of the largely flat curve section.

In Figs. 6 and 7 are illustrated a fourth and a fifth embodiment of a clothing article in the shape of a panty brief 22 and 23, respectively, which are made by a method according to the invention. In these embodiments are illustrated different means and properties of the panty briefs which facilitate taking them off and on. In the two embodiments, the reference number 24 illustrates opening means in the body part. These are shown disposed at one side outside the compression area. Alternatively, they may be provided in both sides of the panty brief. The opening means may include zippers,

Velcro, snap fasteners, hooks, or other reclosable opening devices.

5 A more loose fabric quality in the buttock areas is indicated with the reference number 25. Looser fabric quality may e.g. be provided by different knitting structure, by heat fixation, by using longer stitches, or by other yarn combination than the other part of the panty brief.

10 For further facilitating taking off and putting on, there may be used an easily extendible waist rubber band 26. This may either be knitted in or sewn on. The waist rubber band 26 may on the inner side be provided with anti-skid means, as e.g. a silicone pattern or be formed of yarns with a rubber-like surface. Hereby it becomes possible to achieve a waist rubber band that secures the panty brief, even though it is easily extendible. When the waist rubber band is thus "attached" to the body, the rubber band does not need to be very tight-fitting, facilitating taking the panty brief on and off. An  
15 upper area 27 may be produced with lower compression, or in this area there may possibly be used graduated elasticity from the waist to the upper end of the compression area. This is possible to provide by using other yarns than the yarns used in the compression area or by using looser knitting.

20 In order to facilitate putting on and taking off, it is possible to make a backpiece 28 with reduced compression relative to the compression area 6 at the front side of the panty brief. This difference may be established via heat fixation, by using different yarns or by looser knitting.

25 In the lower part 29 of the panty brief, at the backside and in the groin section, there may be used material without elasticity. This may e.g. be established by using other yarns, a different knitting structure, or with reduced or no use of elastic yarns in the area 29.

30 Alternatively, it is possible to sew in a wedge 30 largely corresponding to the wedge 15 which is mentioned in Fig. 3. The wedge 30 will increase the leg width/groin width and thereby facilitate putting on and taking off.

Fig. 8 shows a sixth embodiment of a panty brief 31 which is suited for a male user. As mentioned before, for ostomy patients it is cumbersome and inconvenient to have to take the panty brief down, e.g. in connection with urination. It is possible to manufacture the panty brief with an open bottom for facilitating using the lavatory. Alternatively, it is possible to provide a panty brief 31 which is provided with a fly 32 instead of the groin opening 10 illustrated in Figs. 1 and 2.

The centre pieces 33, 34 are knitted separately and sewn into the centrepiece of the panty brief with overlap 35. Hereby is created a horizontal fly opening 32 which is preferred since the transverse compression forces may have a tendency to deform/open a usual horizontal fly. This appears particularly from Fig. 9 that the centrepieces 33 and 34 are provided with rib edges 36 at the side of the fly opening 32. This contributes to keeping the fly opening closed and enables avoiding transverse seams at the fly opening.

Fig. 10 shows the seventh embodiment of a clothing article in the shape of a panty brief 37 provided with an opening 38 in the groin area 4 in order to enable urination without needing to pull the panty brief down.

Fig. 11 shows an eighth embodiment of a clothing article according to the invention in the shape of an abdominal belt 39. The abdominal belt 39 consists of a tubular item having a compression area 6 in the lower body part area at a position intended for being placed at the front side of the user.

Different embodiments of clothing articles for use for persons with hernia are illustrated and explained above. Since a large number of persons that will be users of the clothing article also can have other age related disorders, it is possible to use clothing articles as a combination product. The panty brief can e.g. be used for napkin fixation on persons suffering from incontinence. Alternatively, the clothing article can be used for fixing hip protection shells for persons that suffer from osteopsathyrosis and with increased risk of hip fracture caused by falling.